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(71) Applicant: POLYFOAM PRODUCTS, INC. [US/US]; 2400 Spring Stuebner Road, Spring, TX 77389 (US).

(72) Inventors: HUBER, E., Richard; 5403 Braxtonshire Circle, Houston, TX 77069 (US). MURRAY, Pat, L.; 3614 Beech Hill, Spring, TX 77388 (US). FAULKNER, David, H.; 2917 Asherwoods Road, Lakeland, FL 33811 (US). FERRANTE, Robert, L.; 3251 S.W. 133 Road Terrace, Davie, FL 33330 (US).

(74) Agents: ROMMELMANN, Douglas, W. et al.; Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1900 Pennzoil Place, South Tower, 711 Louisiana, Houston, TX 77002 (US).

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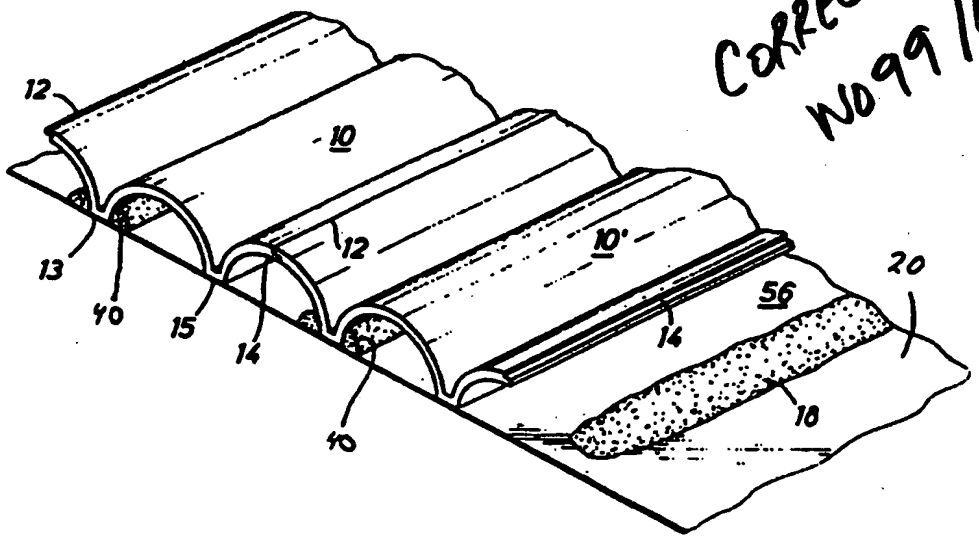

(57) Abstract

The present invention is a pitched roofing system (100) having a sloped deck (50), a waterproof coating (20) integrally adhered and bonded to the deck (50), and a plurality of roof tiles (10) adhered to the waterproof coating (20). The waterproof coating (20) is a liquid formulation applied to the deck (50) and includes a polymer selected from the group consisting of modified acrylic–based bitumen, styrene butadiene rubber, styrene acrylic, vinyl acetate, ethylene vinyl acetate, ethylene modified acrylics, natural and synthetic rubber, and silicone. The adhesive (40) used to bond the roof tiles (10) to the waterproofing coating (20) is a polymer adhesive, preferably a two–component froth liquid polyurethane foam.

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PITCHED ROOFING SYSTEM AND METHOD OF INSTALLING SAME

The present invention relates to a pitched roofing system, and particularly to a system for waterproofing the pitched roof and attaching roofing components, such as roof tiles, and a method for installing the system.

There are two basic types of roofs: flat and pitched. Pitched roofs come in a few basic styles, all of which are relevant to the present invention. A duo-pitched roof has two sloping sides joined along the top with end vertical walls called a gable end. This is probably the most common form of pitched roof. If the end of the roof is also sloping it is termed hipped. If two sections of roof meet at an angle, such as a right angle, the junction between the two roof sections is termed a valley.

Various roof components are used as roof coverings on pitched roof decks. One example of roof component is a roof tile. Roof tiles are extremely durable and provide significant aesthetic and decorative effects to the structures to which they are applied. Roof components or coverings as described herein may be made of cementitious materials and also brick, stone, clay, plastic, wood, metal, rubber or bituminous materials.

A typical pitched roofing system includes sheets of wood, typically plywood or decking material, nailed to the truss rafters to form a pitched roof deck. Other pitched roof decks may be made with materials such as steel or concrete. The pitched roof deck is overlaid with a roof substrate made of a waterproofing material. Typically, the waterproofing material forming the roof substrate is a roll goods membrane or underlayment comprising one or more plies of asphaltic or modified bitumen impregnated felt attached to the pitched roof deck. The felt is typically attached to the pitched roof deck by nails and/or adhesive. Felt is generally made of wood pulp and rag or of asbestos, polyester or glass fibers.

Roof components are secured primarily to the pitched roof deck with mechanical fasteners. Nails are the primary mechanical fasteners for securing roof components to a wood deck. Tile roof components are secured with nails inserted through holes in the tile roof component which are driven through the roof substrate and wood deck. Mortar is sometimes used in conjunction with nails to provide holding force of the tile roof component to the roof deck. In either case, it is undesirable to drive numerous holes through the roof substrate and wood deck since these nail holes provide a potential leak path in the pitched roofing system. High wind loading conditions also affect the roof components secured with nails. In areas near salt water the effectiveness of nails is diminished with time due to

corrosion of the nails. Additionally, nails get loose over a period of time. Some decks, such as concrete or steel decks, cannot be nailed into. Non-nailable decks (concrete, steel, etc.) use a wire tie or other cumbersome and expensive system to fasten the roof components to the pitched roof deck.

As stated above, mortar or similar binders are often used as a secondary fastener between tile roof components and the roof substrate. Using mortar is a slow procedure and labor intensive as the mortar must first be prepared, typically at ground level in buckets which must then be raised to the pitched roof deck, and then the mortar is applied to the roof substrate. The mortar adds unnecessary weight to the roofing system. The set-up time of the mortar increases the time required to form the bond between the tile roof component and the roof substrate. The installed tile roof components should not be disturbed until the mortar has set-up as movement of the tile roof component affects the bond. Furthermore, the strength of the completed bond between the tile roof component and the roof substrate can be unsatisfactory. Typically, an approximate 60-pound tensile load applied transversely to the tile roof component will break the mortar bond between the tile roof component and the roof substrate. During high wind loading conditions, such as that experienced during a hurricane or a tornado, the tile roof components frequently release from the roof structure and become life threatening, flying projectiles. During such events, the tile roof components are widely strewn about and scattered throughout the area. The flying tile roof components result in additional danger during these devastating events and further increase the tremendous burden of clean up after these catastrophic events.

Assignee's U.S. Patent No. 5,362,342 discloses a method of bonding tile roof components to the roof substrate utilizing polyurethane foam as the bonding medium. The method includes the step of applying under low pressure a stream of two component foamable liquid polyurethane on a prepared roof substrate. The foamable liquid polyurethane has a density preferably in the range of one and one-half to two pounds per cubic foot and a reactivity period in the range of one and one-half to four minutes. The foamable liquid polyurethane is preferably applied at a rate in the range of two to three pounds per minute. The tile roof component is placed into contact with the foamable liquid polyurethane during the reactivity period of the foamable liquid polyurethane.

While the bond between the tile roof components and the roof substrate with the polyurethane foam is several times increased over the mortar and mechanical bonds, it has been found that failure of the polyurethane foam bonded, pitched tile roofing system typically occurs with the roof substrate, typically roofing felt, failing to provide a waterproofing barrier

to the roof deck. After a period of years, the hydrocarbon element of the roofing felt volatizes and deteriorates and the underlayment membrane begins to form leak paths for rain and moisture. Additionally, after a period of years the roofing felt loses some of its resistance to tearing and will tear away from the roof deck in a high wind load situation. Thus, the felt waterproofing membrane can be the weakest component of the pitched roofing system, failing in the attachment to the roof deck or in waterproofing integrity. When using an adhesive to attach a roofing component to the waterproofing membrane, the failure of the membrane causes the failure of the waterproofing and attachment system.

It is desirable to have waterproofing and attachment components for a pitched roofing system that provides longer lasting properties than other systems that presently exist. It is desirable to have a pitched roofing system with attachment and waterproofing components having a life expectancy meeting or exceeding the life expectancy of the roof component. It is desirable that the waterproofing component of the system have improved characteristics over roofing felt. It is desirable to have a pitched roofing system that will withstand anticipated severe storm conditions. Furthermore, it is desirable that the method of installation be a simple operation, non-labor intensive, economical and not require excessive installation time. Furthermore, the pitched roofing system, including the waterproofing and attachment components should withstand the long-term effects of temperature and climatic variations experienced by the pitched roofing system under normal circumstances.

The present invention is a pitched roofing system including a waterproofing component for a sloped or pitched roof deck (wood, metal, concrete, etc.) and an attachment component for attaching roofing components (tile, shingles, slate, metal, etc.) to the waterproofing coating. The present invention is particularly suited to a roof having a 2:12 pitch or greater.

The waterproofing and attachment components provide longer lasting properties to the pitched roofing system than other systems that presently exist. The waterproofing component of the present system has improved characteristics over roofing felt. The waterproofing and attachment components will withstand anticipated severe storm conditions. The method of installing the pitched roofing system of the present invention is a simple operation, non-labor intensive, economical and does not require excessive installation time. The pitched roofing system, including the waterproofing and attachment components, will withstand the long-term effects of temperature variations and climatic conditions experienced by the pitched roofing system under normal circumstances.

The waterproofing component of the present invention includes a waterproofing coating, taping, and flashing which, in addition to protecting the pitched roof deck from rain, serves as a superior attachment base for an adhesive used to attach the roofing components to the roof deck with minimum deck penetrations. The waterproofing coating is a liquid-applied polymer modified bitumen, polyurethane, acrylic, styrene acrylic, polyvinyl chloride, vinyl acrylic, vinyl acetate, styrene butadiene, ethylene vinyl acetate, or bitumen latex, or any combination of these waterproofing materials. The waterproofing coating may use either water or organic compounds as the solvent. Preferably, the cured waterproofing coating is stable when shielded from ultraviolet light and contains low or zero volatile organic compounds (VOC's).

The attachment component of the present invention includes a polymer adhesive, preferably polyurethane, for adhering the roofing components to the waterproofing component of the system. The present invention provides a cost-effective method of attaching roofing components with control over variables which have led to roofing system failures in the past.

One method of application of the present invention is to apply flashing and seam protectors on the roof deck followed by a rolled-on or sprayed-on waterproofing coating. Following a suitable curing time, the roof components are installed with a polymer adhesive. An alternative to applying the waterproofing coating to the sloped roof deck is to pre-apply the waterproofing coating during manufacture of the decking.

The objects, advantages, and features of the invention will become more apparent by reference to the drawings which are appended hereto and wherein like numerals indicate like parts and wherein an illustrated embodiment of the invention is shown, in which:

Fig. 1 is a perspective view of a typical roof tile that can be used with the pitched roofing system of the present invention;

Fig. 2 is a perspective view of a pitched roof deck having the seams taped and the deck boards coated with the waterproofing coating;

Fig. 3 is an elevational view of a portion of the pitched roofing system with a lower row of roof tiles being installed;

Fig. 4 is an elevational view of a portion of the pitched roofing system with an upper row of roof tiles overlapping the lower row of roof tiles; and

Fig. 5 is a view taken along line 5-5 of Fig. 4.

The pitched roofing system and method of installing same, generally designated as 100, will now be described in greater detail with specific reference to the drawings. The

pitched roofing system 100 includes a roof component, designated generally as 10, known as a semi-circular roof tile as shown in perspective view in Fig. 1. It is to be understood that the system and method of the present invention 100 is not limited to semi-circular roof tiles. Rather, the system and method 100 can include roof components 10 of other types and configurations. For example, flat roof tiles and reverse curve roof tiles can be used with the system and method 100. Typically, the tile components 10 are made from cementitious or clay materials. It is also to be understood that the system and method of the present invention 100 is not limited to clay or cementitious roof tiles 10 but is also applicable to roof components 10 made from other materials including, but not limited to, brick, stone, plastic, wood, rubber, or bituminous materials.

As shown in Figs. 1 and 3, the semi-circular tile roof component 10 typically includes an interlocking connection at the first and second longitudinal edges 12 and 14, respectively, of the tile roof component 10. Referring to Fig. 3, the second edge 14 of the first tile roof component 10 mates with the first edge 12 of an adjoining second tile roof component 10'. This type of interlocking connection for tile roof components 10 is well known in the art. The tile roof component 10 as shown in Fig. 1 includes a first pan portion 13 and a second pan portion 15. The pan portions 13 and 15 extend the length of the tile roof component 10.

A pitched roof deck, generally designated as 50, is shown in Fig. 2. The pitched roof deck 50 is comprised of sheets of plywood or decking material 52 nailed to a plurality of truss rafters 54 or installed to other structural members or structural supports. The decking material 52 is typically in 4-foot by 8-foot sheets. The sheets of decking material 52 are positioned end to end and side to side as shown in Fig. 2. An inclined seam 52a is formed between the ends of adjacent sheets of decking material 52 and a horizontal seam 52b is formed between the sides of adjacent sheets of decking material 52. Typically, a plurality of nails is driven through the decking material 52 into the truss rafters 54 along the inclined seams 52a. The decking material 52 is also nailed to each of the truss rafters 54 positioned below the sheet of decking material 52. Typically, the truss rafters 54 are on 24-inch or 16-inch centers. A sheet of decking material 52 is thus nailed to approximately 5 or 7 truss rafters 54.

A waterproofing coating 20 (described below) is applied and bonded to the upper surface of the decking material 52. The waterproofing coating 20, in addition to protecting the pitched roof deck 50 from rain, also serves as a superior attachment base for an adhesive (described below) used to attach the roof components 10 to the roof deck 50 with a minimum of deck penetrations. The waterproofing coating 20 is a superior attachment base for an

adhesive because it impregnates into the pitched roof deck 50 and becomes a continuous, monolithic membrane.

Prior art systems typically used felt as an underlayment between the roof component 10 and the pitched roof deck 50. Since the waterproofing coating 20 of the present invention becomes monolithic or one with the pitched roof deck 50, an underlayment used in prior art systems is eliminated. The waterproofing coating 20 of the present invention is not a tar, bitumen or asphaltic felt underlayment. This results in a number of improvements. For example, during wind loading, underlayment movement is eliminated. Prior art underlayment has typically broken down over a short period of time, about 10-20 years or so, due to extreme roof temperatures. The waterproofing coating 20 of the present invention does not break down in a short period of time but rather lasts much longer and maintains elasticity over the life of the pitched roofing system 100. Further, the integrity of the waterproofing coating 20 is higher than a prior art underlayment system because an integral bond is formed with the roof deck 50 which makes the waterproofing coating 20 more resistant to damage caused by stacking of roofing components 10 and construction foot traffic prior to and during installation of the roof components 10.

By bonding the waterproofing coating 20 directly to the roof deck 50, forming a monolithic and integral waterproofed deck, there is a 45-50% increase in wind resistance for a roofing system 100 constructed according to the present invention as compared to a prior art roofing system using some felt underlayment systems. Further, there is considerable variation in prior art underlayment materials and attachment systems which makes wind resistance unpredictable. In contrast, the waterproofing coating 20 can be manufactured to a consistent specification so that test results are consistent and repeatable, and thus, wind resistance is predictable.

Preferably, the waterproofing coating 20 is applied as a liquid to the decking material 52 with a roller, sprayer, brush or mop. The waterproofing coating 20 can be applied to the decking material 52 after it is nailed in place on the pitched roof deck 50 or it can be applied to the decking material 52 prior to installing the decking material 52 on the roof deck 50. The pre-installation of the waterproofing coating 20 can be done on the ground at the construction site or can be applied prior to shipping the decking material 52 to the site. The preferred timing of the application of the waterproofing coating 20 will be dependent on factors relating to specific jobs.

The waterproofing coating 20 is preferably a continuous film coating that can breathe from the underside to prevent dry rot and the build up of heat while maintaining its water

shedding capabilities as a result of its molecular structure. For the waterproofing coating 20 to breathe properly, permeability should range between 1 and 20 perms, while a permeability of about 5 perms (3.5 grains/ft^2/hr) is preferred. The waterproofing coating 20 in combination with the flashing material (commonly used along the roof edges, ridges, and valleys) form a continuous monolithic sheet to ensure its water shedding properties.

The thickness of the waterproofing coating 20 may be increased or decreased to obtain the desired longevity. The thickness of the waterproofing coating 20 is preferably between about 15 and about 40 mils, which depends on the material used for the waterproofing coating 20. A thickness of about 20 mils is typical, and in general, the thicker the coating, the better the performance and longevity of the waterproofing coating 20. It is anticipated that the the waterproofing coating may have an application life that is typically greater than 25 years. Preferably, the waterproofing coating 20 is stable when shielded from ultraviolet light and contains low or zero volatile organic compounds (VOC's). For example, by using a latex-based formulation for the waterproofing coating 20, the solvent is water, rather than an organic compound, which eliminates organic emissions caused by the evaporation of the solvent. Although not preferred, the waterproofing coating 20 may be used in conjunction with a mechanically fastened roof component system.

A latex polymer dispersion in the waterproofing coating 20 may be based on one or combinations of the following materials: modified acrylic-based bitumen; styrene butadiene rubber (SBR); styrene acrylic; vinyl acetate; ethylene vinyl acetate (EVA); ethylene modified acrylics; polyurethanes; chlorinated polymers; cementitious modified acrylics; natural and synthetic rubber; and silicone. Preferably, the waterproofing coating 20 is a modified acrylic-based latex. For a lower cost application, bitumen-based materials may be used and are less expensive than the other materials listed above, however bitumen-based materials generally exhibit poorer aging performance as compared to acrylic-, styrene-acrylic-, or butadiene-based formulas.

A typical latex formulation suitable for use as the waterproofing coating 20 is Evercoat available from Everest Coatings of Spring, Texas. Other latex formulations suitable for use as the waterproofing coating 20 are Sealoflex Pink and Sealoflex Finish Coat available from Sealoflex. A suitable waterproofing coating 20 using an organic compound as the solvent is MULT-I-THANE System 3000 available from Carlisle Coatings & Waterproofing Incorporated of Fontana, California.

In prior art systems such as described in U.S. Patent No. 5,362,342, issued to Murray et al., roof tiles are adhered to a roof substrate, which is made of a waterproofing material

such as asphalt, tar, or one of more plies of felt. Prior art waterproofing material, which is typically felt, is attached to a roof, typically by nails. Felt tends to expand and wrinkle with aging and may tear or separate, particularly where fastened, such as at nail heads, when subjected to a force. Wrinkles in the felt beneath the roof tile results in the ponding of rainwater, which leads to leaks through the roofing system. As felt products age, solvents and plasticizers are volatilized from the felt, and the felt becomes more brittle over time and thus more susceptible to failure.

The waterproofing material used in the prior art exemplified by U.S. Patent No. 5,362,342 is a weak link in the roofing system. The roofing tiles are adhered to the waterproofing material, typically a felt, and the waterproofing material is fastened, mechanically or by adherence, to the roof deck. The waterproofing material of the prior art is bonded to the roof deck either by mechanical fasteners or by adhesion, but its bond strength is low. Since the roof tiles are bonded or adhered to the waterproofing material, the bond strength of the roof tiles, and thus their wind resistance, is dependent on the bond strength of the waterproofing material.

In the present invention, the waterproofing coating 20 has a high bond strength as compared to mechanically attached felt. The waterproofing coating 20 adheres tightly to decking material 52 and has a higher bond strength than does mechanically attached felt. Because the waterproofing coating 20 is applied as a coating, it is adhered at all points to decking material 52, unlike felt that is adhered at a few points by mechanical fasteners or by an adhesive. Further, the waterproofing coating 20 is a strong material with a high tear strength as compared to felt. Felt is a relatively soft material, and little force is required to tear apart the internal bonds within the material. On the other hand, the internal bonds in the waterproofing coating 20 are strong bonds, and a great deal more force is required to tear apart these internal bonds.

Consequently, the static uplift force that a roof constructed according to the present invention can withstand is significantly greater than the static uplift force that a roof constructed according to the prior art can withstand. The waterproofing coating 20 is a strong material that forms a strong bond with the decking material 52, and a strong bond can be formed between roof component 10 and waterproofing coating 20, as described further below, so that the roofing system of the present invention can withstand high wind forces. Thus, not only is the present pitched roofing system 100 superior for its long term water shedding ability, it is highly superior for resisting static uplift forces caused by high winds in wind storms, hurricanes, tornadoes, and the like.

Referring to Fig. 2, the seams 52a and 52b are potential leak paths for rain and moisture. A gap exists along the seams 52a and 52b due to the expansion and contraction of the sheets of decking material 52. Preferably, the seams 52a and 52b are sealed with a reinforcing or bridging strip 30 as shown in Fig. 2. The bridging strip 30 is run the length of the seams 52a and 52b and adhered to the decking material 52. The bridging strip 30 is a reinforcing membrane for the waterproofing coating 20 over the seams 52a, 52b and accommodates the expansion and contraction of the decking material 52.

The bridging strip 30 is preferably suitable for adhering to wood and has a width of approximately 1-1/2 to 4 inches. Preferably, the width of the bridging strip 30 is sufficient to cover the plurality of nails along the ends of the decking material 52. The bridging strip 30 may be a fabric or fabric tape adhered to the decking material 52. In the case of reroofing where numerous nails have penetrated the plywood substrate or when older decking substrate practices were used (i.e., 1" x 6" tongue and groove panels or 1" x 10" plank decking), the entire roof deck may have to be coated and installed with reinforcing fabric such as fiberglass, nylon, or woven polyester. The reinforcing fabric is available and can be installed in various widths and lengths depending on the roof plane pitch, the weight of the fabric, convenience and ease of installation. The bridging strip 30 may be made of a waterproof material to prevent the passage of rain or moisture. A suitable bridging strip 30 is reinforcing fabric with or without adhesive and may be made of materials such as fiberglass, nylon, or woven polyester. A material suitable for use as the bridging strip 30 is available from Carlisle Coatings & Waterproofing.

The roof component 10 is attached to the waterproofing coating 20 and the bridging strip 30 of the roof deck 50 with a polymer adhesive 40. Preferably, the polymer adhesive 40 is a polyurethane described in greater detail below. A method of attaching the roof components 10 and a typical polymer adhesive 40 are disclosed in U.S. Patent No. 5,362,342, issued to Murray et al., which is incorporated by reference. However, it is to be understood that the present invention is not limited to the method and adhesive disclosed in U.S. Patent No. 5,362,342.

The preferred method of attaching the roof components 10 with the polymer adhesive 40 is shown in Figs. 3-5. Referring to Fig. 3, the roof components 10 are installed in rows beginning along the lower edge of the roof. One or more paddies 18 are located at the position where the first pan portion 13 of the roof component 10 will be situated on the waterproofing coating 20 of the pitched roof deck 50. The roof component 10 is then adhered to the waterproofing coating 20. Referring to Fig. 3, a worker places one or more

paddies 18 of the polymer adhesive 40 on the waterproofing coating 20 at a location at which the roof component 10' is to be applied. The roof component 10' is placed adjacent to the previously installed roof component 10 so that the first edge 12 of the second roof component 10' overlaps and interlocks the second edge 14 of the first roof component 10. The first pan portion 13 of the roof component 10 is positioned in and above the paddy or paddies 18 of polymer adhesive 40 during the reactivity period of the polymer adhesive 40. Due to the interlocking connection of adjacent roof components 10 as shown in Fig. 3, the polymer adhesive 40 is not required beneath the second pan portion 15 of the roof component 10. One or more paddies 18 beneath the second pan portion 15 may be used to obtain an even greater bond between the waterproofing coating 20 and the roof component 10, if desired.

The polymer adhesive 40 may be a foamable or a non-foamable polymer adhesive. Preferably, the polymer adhesive 40 is a plural component, liquid polyurethane foam. The significant advantage of the plural component polyurethane foam is being able to walk on the installed roof components 10 shortly after the roof components 10 have been installed without affecting the bond between the roof component 10 and waterproofing coating 20. The reactivity period or rise time of the plural component liquid polyurethane foam 40 of the present invention is preferably about one-half to about ten minutes and most preferably about one and one-half to about four minutes. It is important that the roof component 10 be properly placed during the reactivity period to achieve the required bonding of the roof component 10 to the waterproofing coating 20. During the reactivity period, the liquid polyurethane foam 40 is an expanding foam, which will fill gaps and imperfections. The resulting foam provides excellent bonding between the roof component 10 and the waterproofing coating 20 due to the adhesive properties of the urethane. It has been found that a reactivity period of less than about one-half minute makes it difficult to timely place the roof component 10 during the reactivity period.

The foamable liquid polyurethane 40 is preferably a froth foam. Froth foam chemistry is well known in the art of urethane foams. The froth foam may be formed by using blowing agents such as hydrogenated chlorofluorocarbon R22 (HCFC-R22), hydrogenated fluorocarbon 134A (HFC-134A), or chlorofluorocarbon R12 (CFC-R12). Preferably, the froth foam 40 is formed by using the hydrogenated blowing agents HCFC-R22 or HFC-134A and not CFC-R12 due to CFC-R12's reported deleterious effects to the earth's ozone layer.

In the preferred method, the froth foam 40 has a consistency similar to a foamy shaving cream. The froth foam is preferable over other types of foams because it can be

neatly and accurately dispensed without blowing or overspraying onto other areas of the roof deck or onto the outer surface of adjacently installed roof components 10. The preferred liquid polyurethane 40 with its shaving cream consistency does not run when placed onto a steeply pitched roof, but remains where it is installed on the waterproofing coating 20. This ensures that the adhesive bond will be formed at the appropriate locations of the roof component 10. Additionally, the froth foam 40 begins expanding immediately upon application to the waterproofing coating 20 and results in a firm bond with the underside of the roof component 10.

The liquid polyurethane 40 preferably has a density of about one to about eight pounds per cubic foot. It may be desirable to minimize the density of the liquid polyurethane 40 to minimize the weight on the roof while still providing an excellent bonding of the roof component 10 to the waterproofing coating 20. It has been found to be most preferable to have a foam density of about one and one-half to about two pounds per cubic foot. The application rate of the liquid polyurethane 40 is preferably about one to about six pounds per minute and most preferably about two to about three pounds per minute.

Referring to Figs. 4 and 5, a second row of roof components 10 is shown overlapping the lower row of roof components 10. As shown in Fig. 5, the first pan portion 13 does not rest on the waterproofing coating 20 along its entire length. The first pan portion 13 at the highest end of roof component 10 comes into contact or very near contact with the waterproofing coating 20 but moves gradually away from the waterproofing coating 20 at the lowest end where it overlaps the lower roof component 10. The foamable liquid polyurethane 40 expands and fills the gaps between the waterproofing coating 20 and the first pan portion 13. The excess foam continues expanding and provides further bonding with adjacent surface areas of the roof component 10 as shown in Figs. 3-5. A thin layer of foam may be present between the waterproofing coating 20 and the first pan portion 13 at the highest end of the roof component 10 depending on the placement of the paddy or paddies 18.

Referring to Fig. 5, the expanding foam 40 also provides a bond between the upper roof component 10 and the lower roof component 10 at the overlapping portion where the expanding foam can fill any gap between the two roof components 10. This further enhances the overall bonding capacity of the roof components 10 to the waterproofing coating 20.

One embodiment of a pitched roofing system and method of installing same according to the present invention has thus been set forth. However, the invention should not be unduly limited to the foregoing, which has been set forth for illustrative purposes only. Various

modifications and alterations of the invention will be apparent to those skilled in the art, without departing from the true scope of the invention.

CLAIMS

What is claimed is:

1. A pitched roofing installation system for waterproofing a pitched deck and attaching roof components thereto, the installation system comprising:

a waterproofing coating to be adhered and bonded to the pitched roof deck, said waterproofing coating including a polymer selected from the group consisting of: modified acrylic-based bitumen, styrene butadiene rubber, styrene acrylic, vinyl acetate, ethylene vinyl acetate, ethylene modified acrylics, polyurethanes, chlorinated polymers, cementitious modified acrylics, natural and synthetic rubber, and silicone; and

a polymer adhesive to be adhered to said waterproofing coating and to the roof components for securing the roof components to said waterproofing coating.

2. The pitched roofing installation system of claim 1, wherein said polymer is a latex polymer.

3. The pitched roofing installation system of claim 1, wherein said polymer adhesive is a polyurethane.

4. The pitched roofing installation system of claim 1, wherein said polymer adhesive is a foamable polymer adhesive.

5. The pitched roofing installation system of claim 4, wherein said polymer adhesive is a plural component, liquid polyurethane foam.

6. The pitched roofing installation system of claim 1, wherein said waterproofing coating is a modified acrylic-based bitumen.

7. The pitched roofing installation system of claim 1, further comprising a bridging strip for sealing seams in the roof deck.

8. The pitched roofing installation system of claim 7, wherein said bridging strip is a reinforced fabric made of a material selected from the group consisting of fiberglass, nylon and woven polyester.

9. A method of installing a pitched roofing system having a plurality of roof tiles and a pitched roof deck, the method comprising the steps of:

applying an adhering waterproofing coating to the pitched roof deck, the waterproofing coating including a polymer selected from the group consisting of: modified acrylic-based bitumen, styrene butadiene rubber, styrene acrylic, vinyl acetate, ethylene vinyl acetate, ethylene modified acrylics, polyurethanes, chlorinated polymers, cementitious modified acrylics, natural and synthetic rubber, and silicone; and

adhering the roof tiles to the waterproofing coating.

10. The method of claim 9, wherein said roof tile adhering step comprises:

applying a stream of a polymer adhesive on the waterproofing coating;

placing a portion of a lower surface of a first roof tile in substantial contact with the stream of polymer adhesive; and

allowing the polymer adhesive to bond the first roof tile to the waterproofing coating.

11. The method of claim 10, wherein the polymer adhesive is a polyurethane foam.

12. The method of claim 10, wherein the polymer adhesive is a two component froth liquid polyurethane foam having a density of about one to about four pounds per cubic foot and a reactivity period of about one half to about ten minutes.

13. The method of claim 9, wherein the waterproofing coating is applied by spraying.

14. The method of claim 9, wherein the waterproofing coating is applied with a roller.

15. The method of claim 9, further comprising the step of sealing seams in the roof deck using bridging strips to cover the seam and a portion of the roof deck proximate to the seam.

16. The method of claim 15, wherein the bridging strips are a reinforced fabric made of a material selected from the group consisting of fiberglass, nylon and woven polyester.

17. In a pitched roofing system having a sloped deck and overlapping roof components, the improvement comprising:

a liquid waterproofing coating applied to the deck; and

a polymer adhesive adhering the overlapping roof components to said waterproofing coating.

18. The pitched roofing system of claim 17, wherein said waterproofing coating includes a polymer selected from the group consisting of modified acrylic-based bitumen, styrene butadiene rubber, styrene acrylic, vinyl acetate, ethylene vinyl acetate, ethylene modified acrylics, polyurethanes, chlorinated polymers, cementitious modified acrylics, natural and synthetic rubber and silicone.

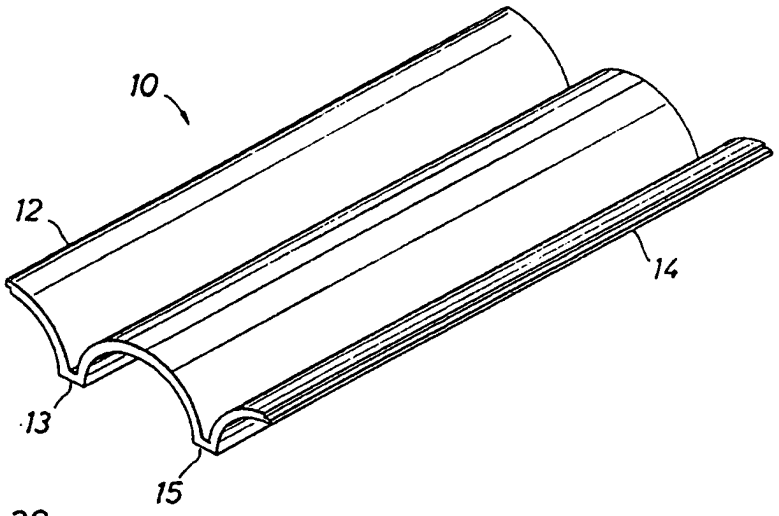
19. The pitched roofing system of claim 17, wherein said waterproofing coating has a thickness ranging from about 15 mils to about 40 mils.

20. The pitched roofing system of claim 17, wherein said waterproofing coating has a permeability ranging from about 1 perm to about 20 perms.

21. The pitched roofing system of claim 17, wherein said waterproofing coating is a latex formulation including a latex polymer.

22. The pitched roofing system of claim 17, wherein said waterproofing coating forms a film bonded integrally to the deck.

FIG. 1



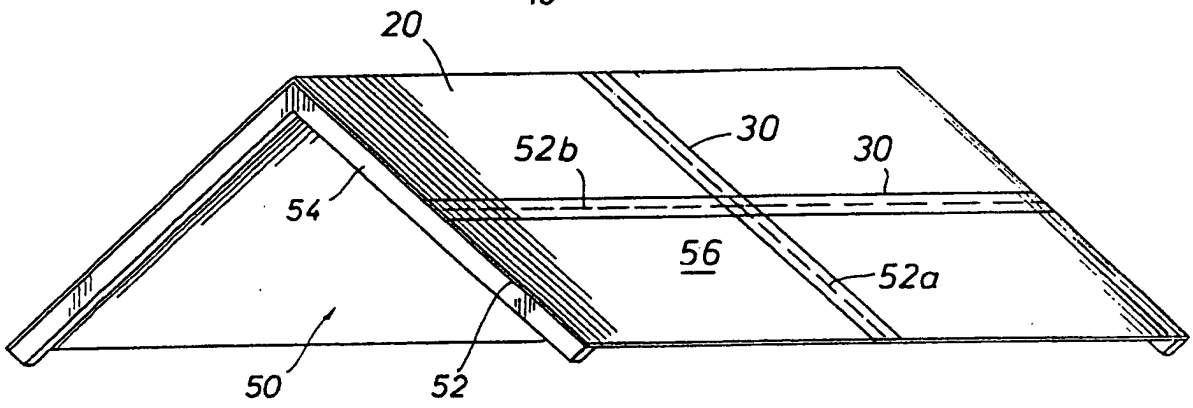


FIG. 2

FIG. 3

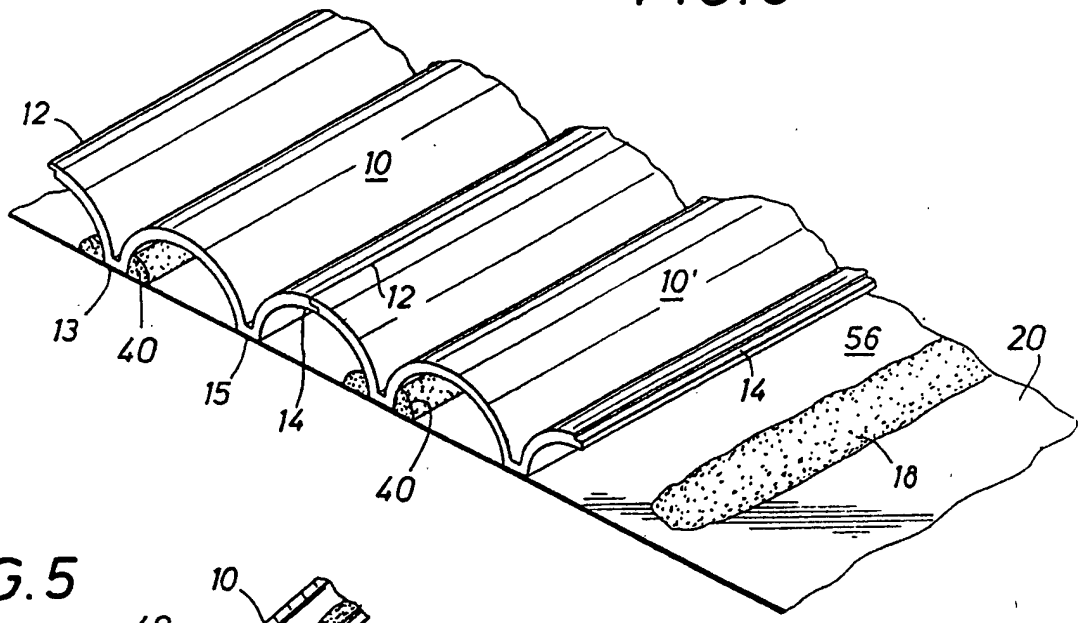
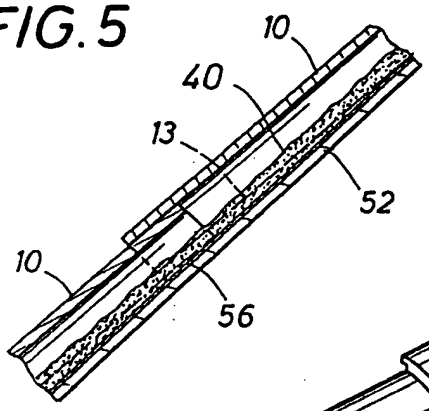


FIG. 5



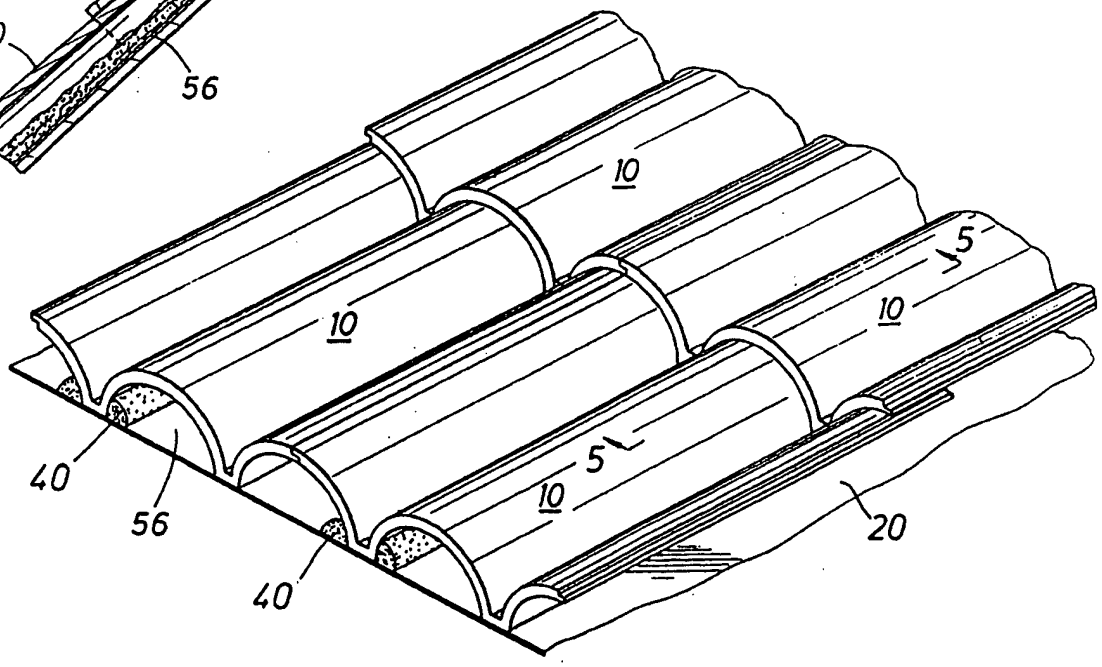


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/03668

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) : E04B 7/02; E04D 11/00
US CL :Please See Extra Sheet.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
U.S. : 52/309.5, 309.8, 408-412, 518, 741.1, 745.06, 746.1, 746.11, 747.1 748.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,362,342 A (MURRAY et al) 08 November 1994 (08/11/94) see entire description.	1-6, 9-14, 17-22
Y	US 4,344,571 A (KUNDIG) 17 August 1982 (17/08/82), see entire description.	1-6, 9-14, 17-22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search
07 MAY 1999

Date of mailing of the international search report
24 JUN 1999

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. (703) 305-3230

Authorized officer
ROBERT CANFIELD
Telephone No. (703) 308-2168

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/03668

A. CLASSIFICATION OF SUBJECT MATTER:
US CL :

52/309.8, 409, 411, 518,741.1, 746.11, 748.1;
156/71

8, RUE DE L'ODÉON, 75006 PARIS

PIERRE COUSIN
MYRIAM MOATTY
J. M. CHEVALIER
Avocats à la Cour

TÉL. 33 (0) 1 56 24 09 08
FAX 33 (0) 1 56 24 08 18

Monsieur Jean Claude HENNION
Cabinet BEAU DE LOMENIE
27bis, rue du Vieux Faubourg
59800 LILLE

09

Paris, le 10 août 2004

11/08/04 -

Fax n° 03.20.63.28.75

AFFAIRE : BARBIER / TECHNICALU HEXA
V/REF. : 1H901200 - JCH/MJ

Cher Monsieur,

J'ai été amené à modifier une nouvelle fois les deux projets de requêtes et d'ordonnances à fin de saisie-contrefaçon pour tenir compte d'un modèle plus récent que m'a, dans l'intervalle, adressé mon correspondant de TOULOUSE.

Vous trouverez les projets ainsi modifiés joints à la présente télécopie.

Je reste dans l'attente de vos instructions.

Je vous prie de croire, Cher Monsieur, en l'assurance de mes sentiments les meilleurs.

P.O.